Species Diversity, 2002, 7, 345–361

Two New Species of *Parhyale* (Crustacea: Amphipoda: Hyalidae) from Southeastern Japan and the Philippines

Takehiko Hiwatari

Japan Science and Technology Corporation
E-mail: hiwatari.takehiko@nies.go.jp
Present address: *National Institute for Environmental Studies,*
16-2 Onogawa, Tsukuba, Ibaraki, 305-0053 Japan

(Received 25 January 2002; Accepted 10 July 2002)

Parhyale hachijoensis sp. nov., from the Izu Islands of Japan, is characterized by the following features: in maxilla 1 the palp is 2-articulate with the articulation near the middle of the palp; in gnathopod 1 one of the palmar corner spines on the propodus is displaced to the posterior margin; in pereopods 6 and 7 the posterior margins of the propodi are lined with 4 and 3 groups of spines, respectively; in uropod 1 the peduncle has an ordinary distolateral spine; and in uropod 3 the inner ramus is vestigial and fused to the peduncle. *Parhyale philippinensis* sp. nov., from two sites in the Philippines, is characterized by the following features: in maxilla 1 the palp is 1-articulate with a constriction slightly beyond the middle of the palp; in gnathopod 1 the palmar corner spines of the propodus are close together; in pereopods 6 and 7 the posterior margins of the propodi are lined with 5 groups of spines; in uropod 1 the peduncle has an elongate distolateral spine; and in uropod 3 the inner ramus is fully articulated. The fact that both new species have the propodal posterior margins lined with a number of groups of spines in pereopods 6 and 7 suggests that they belong to the *P. hawaiensis* complex.

Key Words: Amphipoda, Hyalidae, *Parhyale*, Southeastern Japan, the Philippines.

Introduction

Parhyale, described by Stebbing (1897), retains an inner ramus on uropod 3. This is a primitive mark in the Hyalidae, which is shared with the genus *Parallorchestes* (Barnard 1979). *Parhyale* is distinguished from *Parallorchestes* by the number of articles of the palp on maxilla 1: in *Parhyale* the palp is 1-articulate and in *Parallorchestes* it is 2-articulate (Barnard and Karaman 1991). Thirteen species are currently assigned to *Parhyale* (Barnard 1979; Arresti 1989).

Parhyale hawaiensis (Dana, 1853) and *P. fascigera* Stebbing, 1897, with full articulation of the inner ramus on uropod 3, were discovered to be distributed in the tropics (e.g., Barnard 1979). Thereafter, since Krapp-Schickel (1974) found a progressive incorporation of this inner ramus in the Mediterranean Sea species [e.g., *P. aquilina* (Costa, 1853) and *P. plumicornis* (Heller, 1867)], which formerly had been assigned to a different genus, the species number of the genus *Parhyale* has increased and the distribution range of the genus has been extended into the warm-temperate fringe of the tropics (Barnard 1979).

Of the 13 species of *Parhyale*, four species, known as the *P. hawaiensis* complex—*P. hawaiensis*, *P. multispinosa* Stock, 1987 from the Canary Islands, *P. iwasai* Shoemaker, 1956 from Taiwan and southern Japan, and *P. basrensis* Salman, 1986 from Iraq—have groups of spines on the propodal posterior margins of pereopods 6 and 7.

In the present paper two new species of *Parhyale* from southeastern Japan and the Philippines having groups of spines on the propodal posterior margins of pereopods 6 and 7 are described, and a new generic characteristic of *Parhyale* is discussed.

Materials and Methods

Samples were collected by Dr. S. Suda from the intertidal zone at Senjojiki, Hachijo Island, Izu Islands, Japan, and by the author at Cagayan De Oro on Mindanao and at Tandoyong Island off northwestern Luzon in the Philippines. The samples were fixed in 5% buffered formalin sea-water solution and then transferred to 70% ethanol. Each individual was dissected and then mounted in polyvinyl-lactophenol and stained with lignin pink. All drawings of dissected appendages were made with the aid of a camera lucida. The type material of the two new species is deposited in the National Science Museum, Tokyo (NSMT).

Systematics

Family **Hyalidae** Bulycheva, 1957

Genus ***Parhyale*** Stebbing, 1897

Parhyale hachijoensis sp. nov.

(Figs 1–4)

[Japanese name: hachijo-minamimokuzu, new]

Material examined. One male and 1 female under cobbles from the intertidal zone at Senjojiki, Hachijo Island (33°03′N, 139°50′E), 17 April 1984. Holotype: male (NSMT-Cr.13927, slide mount), 9.4 mm, Hachijo Island, 17 April 1984. Allotype: female (NSMT-Cr.13928, slide mount), 8.1 mm, same data as holotype.

Diagnosis. Antennae 1 and 2: flagella long, with 17 and 26+ articles, respectively; antenna 2 with peduncular articles 4 and 5 elongate. Eyes: relatively small, reniform. Maxilla 1: palp 2-articulate with articulation near midlength. Maxilliped: ventrodistal margin of palp article 3 with dense long setae. Gnathopod 1: carpus lobe, broad, with deeply serration and pectinate long setae; 2 spines on palmar corner of propodus displaced from each other; dactylus not aquilinized. Gnathopod 2: carpus lacking posterior lobe. Pereopods 6 and 7: posterior margin of propodus lined with 4 and 3 groups of spines, respectively. Uropod 1: distolateral spine of peduncle of ordinary size. Uropod 3: inner ramus fused to peduncle, vestigial, armed distally with small seta.

Description. *Male* (holotype). Head (Fig. 1g): relatively small; anterior margin of lateral cephalic lobe slightly convex; eyes small, reniform.

Antenna 1: peduncular article 3 not reaching end of peduncular article 4 of antenna 2; posterior margin of peduncular articles 2 and 3 with 3 and 2 pairs of spines, respectively (Fig. 2a); each article of flagellum with 2 short aesthetascs (Fig. 1c); flagellum 17-articulated. Antenna 2: relatively long, about 60% of body length; peduncular article 5 subequal in length to articles 3 and 4 combined; inner face of peduncular articles 4 and 5 with short spines, posterior margins with 4 groups of spines (Fig. 2b); each article of flagellum with 2 groups of short setae distally (Fig. 1d); flagellum with 26+ articles, twice as long as peduncle.

Upper lip (Fig. 1a): anterior margin rounded with bristles. Left mandible (Fig. 2e): lacinia 5-dentate with 6 accessory blades. Right mandible (Fig. 2f): lacinia with 4 accessory blades, distal end of molar with long, plumose seta. Lower lip (Fig. 1e): ordinary, inner lobes indistinct. Left and right maxilla 1 (Figs 2c, 4d): palp 2-articulate with articulation near middle of palp. Maxilla 2 (Fig. 2d): inner plate with large pectinate seta at middle of medial margin; apical setae of outer plate longer than that of inner. Maxilliped (Fig. 2i): palp articles 2 and 3 broad; article 4 (Fig. 2j) slender, outer and inner margins with 1 and 7 setae, respectively; ventrodistal margin of article 3 of palp with dense group of long setae.

Gnathopod 1 (Fig. 2k): basis with 2 stiff setae on middle of posterior margin; ischium and merus both with long setae; carpus lobe broad, with deep serration and pectinate long setae (Fig. 2m); propodus expanded distally, palm oblique, defined by spine (outer), posterodistal margin with short spine (inner) (Fig. 2l), middle of posterior margin with serration and pectinate long setae, inner face with 5 groups of setae; dactylus not aquilinized. Gnathopod 2: basis with anterior margin slightly concave and lined with small setae; merus weakly extended; propodus with palm oblique, simple, lined with short spines (Fig. 3a), palm slightly shorter than posterior margin, posterior margin with several groups of short setae; dactylus fitting palm. Pereopods: pereopods 3–7 each with pair of locking spines; pereopods 3 (Fig. 3b) and 4 with locking spines subequal in size, posterior margins of propodi lined with 3 spines (excluding locking spines); pereopods 5–7 (Fig. 3c, d, e) with distal locking spine larger, anterior margins of propodi lined with 4 groups of spines; pereopods 6 and 7 with posterior margins of propodi lined with 4 and 3 groups of spines, respectively.

Coxae: coxa 1 (Fig. 1g) extended forward; coxae 2 and 3 with lower margin rounded; coxae 1–3 with middle of posterior margin projecting, softly pointed; coxa 4 broad, with bisinuate posterodorsal excavation; coxal gills of medium size.

Pleopods 1–3: each peduncle bearing 2 hook spines; inner margin of basal articles of inner rami lined with 3, 4, and 3 bent-tip spinules, respectively.

Epimeron 1 (Fig. 1g): lower margin rounded, posterior margin with 2 small setae. Epimeron 2: posterior margin with 4 small setae. Epimeron 3: posterodistal corner subacute, with 4 small setae posteriorly.

Uropod 1 (Fig. 1g): peduncle slightly longer than rami, with marginal spines and ordinary-sized distolateral spine; inner and outer rami with 3 and 2 dorsal spines, respectively. Uropod 2: inner and outer rami with 2 and 1 dorsal spines, respectively. Uropod 3 (Fig. 1f): peduncle widely expanded, with 1 main spine; inner ramus fused to peduncle, vestigialy, armed distally with small seta; outer ramus obliquely truncate, bearing 8 spines.

Telson (Fig. 1b): cleft completely, inner margin of lobe with short comb setae, lateral margin of lobe with 2 plumose setae, apical margin with plumose seta and

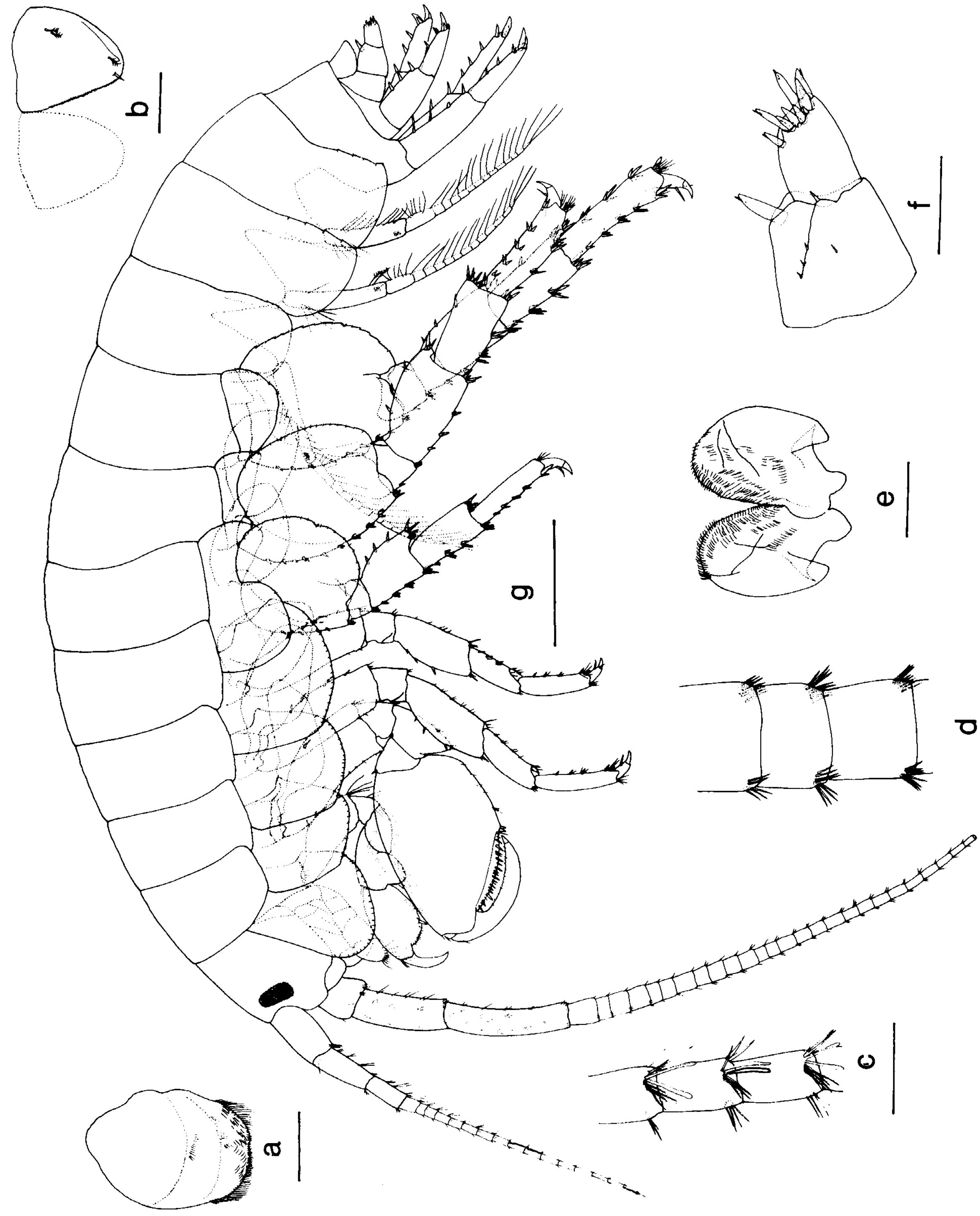

Fig. 1. *Parhyale hachijoensis* sp. nov., holotype (male, 9.4 mm). a, upper lip; b, telson; c, part of flagellum of antenna 1; d, part of flagellum of antenna 2; e, lower lip; f, uropod 3; g, lateral view. Scale bars: g=1 mm; a–f=0.2 mm.

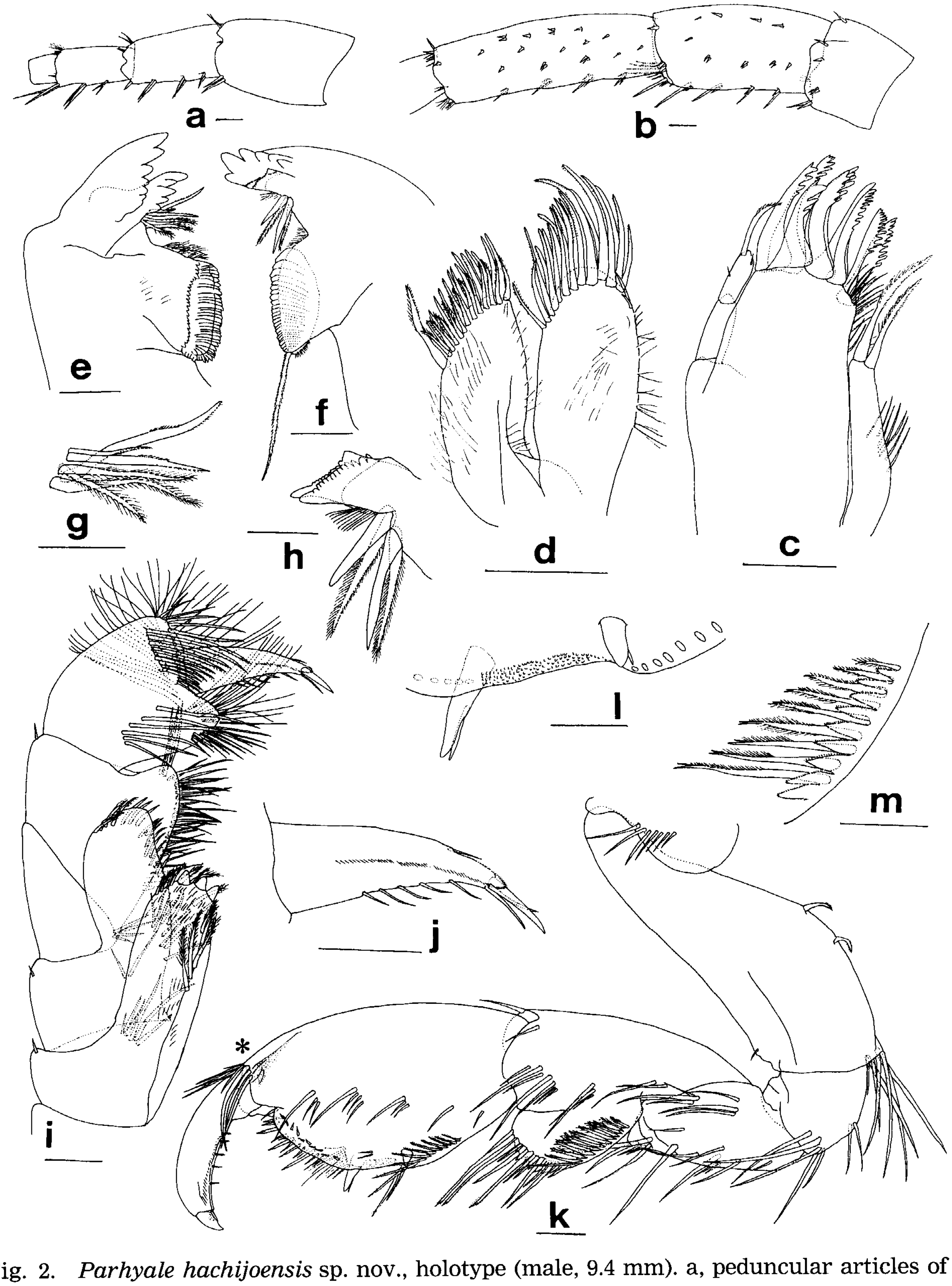

Fig. 2. *Parhyale hachijoensis* sp. nov., holotype (male, 9.4 mm). a, peduncular articles of antenna 1; b, peduncular articles of antenna 2; c, left maxilla 1; d, maxilla 2; e, left mandible; f, right mandible; g, accessory blades of left mandible; h, lacinia mobilis and accessory blades of right mandible; i, maxilliped; j, article 4 of maxilliped palp; k, gnathopod 1; l, two palmar corner spines and margin of propodus of gnathopod 1; m, part of deep serration and pectinate long setae of carpal lobe of gnathopod 1. * Unclear area due to faulty slide mount. Scale bars: a–f, i, j, k=0.1 mm; g, h, l, m=0.05 mm.

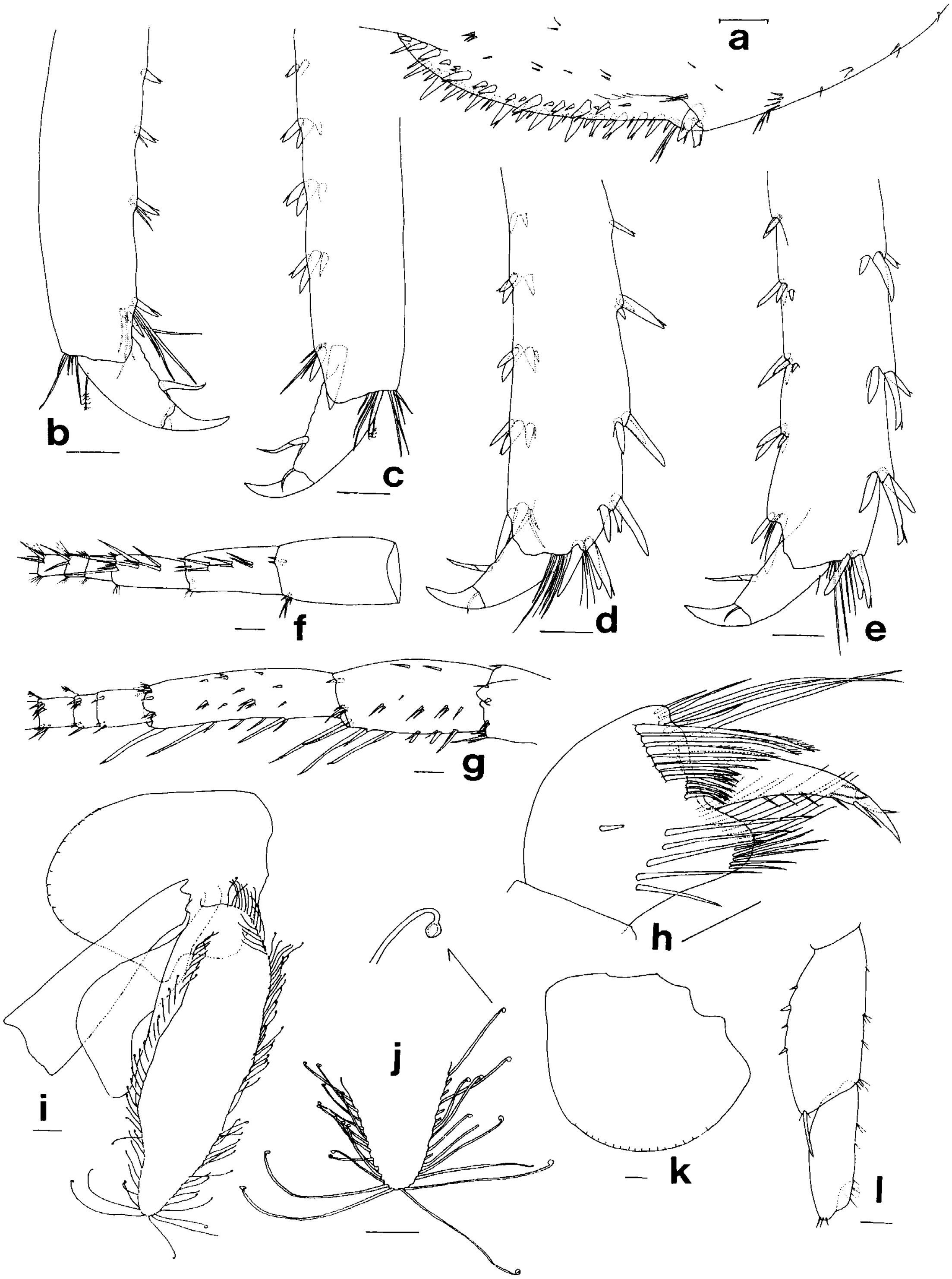

Fig. 3. *Parhyale hachijoensis* sp. nov. a–e, holotype (male, 9.4 mm): a, propodal palm margin of gnathopod 2; b–e, propodi and dactyli of pereopods 3, 5, 6, and 7, respectively. f–l, allotype (female, 8.1 mm): f, proximal part of antenna 1; g, proximal part of antenna 2; h, articles 3 and 4 of maxilliped palp; i, coxa 2 and brood plate; j, brood setae of brood plate, with detail of one seta; k, coxa 4; l, merus and carpus of pereopod 3. Scale bars: a–l = 0.1 mm.

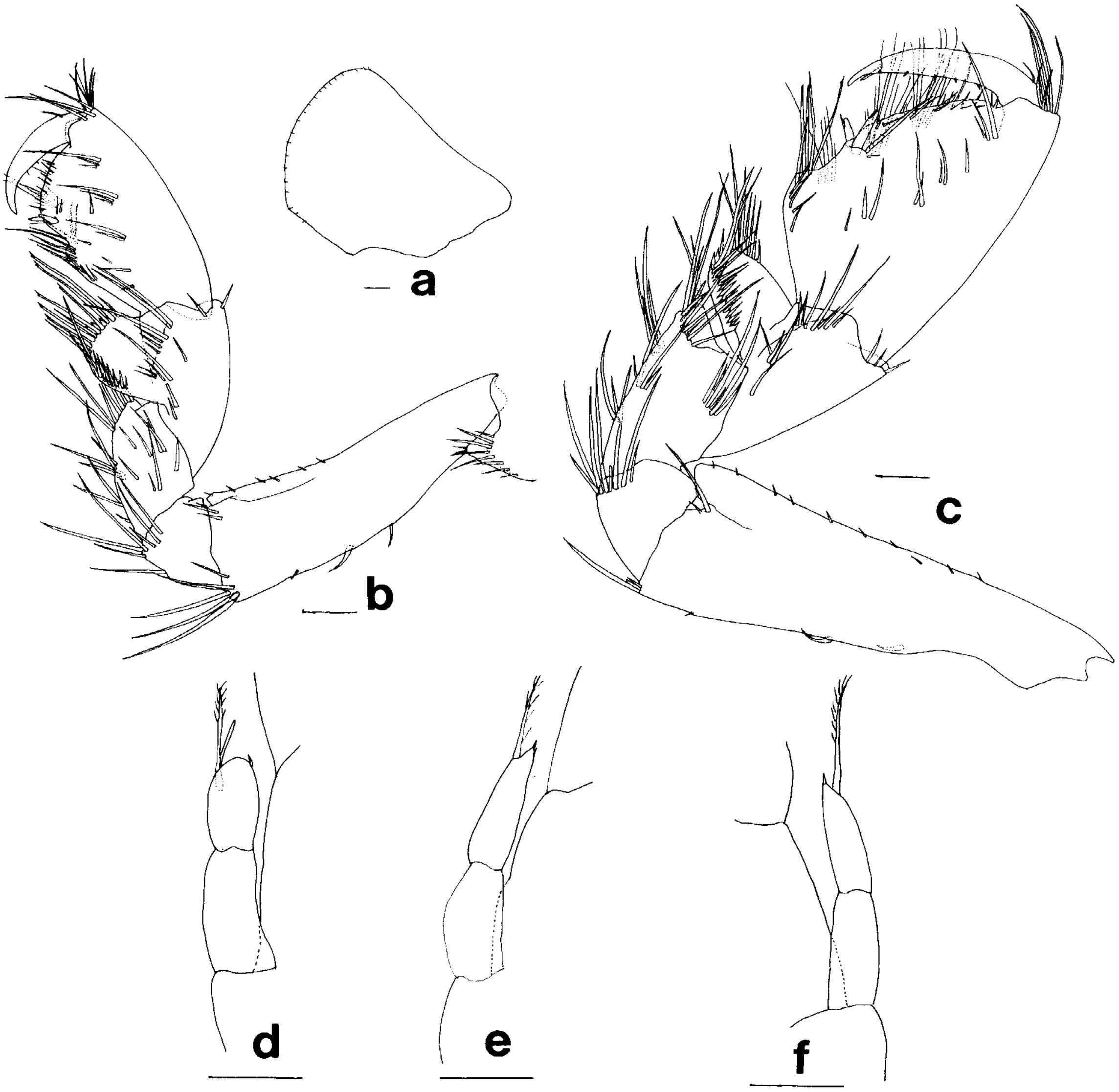

Fig. 4. *Parhyale hachijoensis* sp. nov. a–c, e, f, allotype (female, 8.1 mm): a, coxa 1; b, gnathopod 1; c, gnathopod 2; e, palp of right maxilla 1; f, palp of left maxilla 1. d, holotype (male, 9.4 mm), palp of right maxilla 1. Scale bars: a–c=0.1 mm; d–f=0.05 mm.

short spine.

Female (allotype). Antenna 1: posterior margins of peduncular articles 2 and 3 each with 3 pairs of spines (Fig. 3f). Antenna 2 (Fig. 3g): peduncular articles 4 and 5 shorter than those of male, spines of posterior margins of peduncular articles 4 and 5 longer than those of male.

Left and right maxilla 1 (Fig. 4e, f): palp 2-articulate, with articulation in middle of palp. Maxilliped: setae of article 3 of palp not as dense as in male (Fig. 3h).

Gnathopods (Fig. 4b, c) heavily setose. Gnathopod 1: basis slender; carpus lobe deeper than merus, with deep serration and pectinate long setae; propodus subrectangular, its palm oblique, simple, defined by 2 spines, middle of posterior margin with tumidity bearing long setae; dactylus fitting palm. Gnathopod 2: basis with extended anterodistal corner; merus with extended distal corner; carpus lobe

Table 1. Comparison of *Parhyale* species belonging to the *Parhyale hawaiensis* complex, in which all members have groups of spines on the propodal posterior margins of pereopods 6 and 7.

Characteristic	*P. hawaiensis* (Dana, 1853)	*P. multispinosa* Stock, 1987	*P. iwasai* Shoemaker, 1956
Antenna 2, number of flagellar articles	24–29	23	30
Maxilla 1, palp	1-articulate, constriction in middle*	1-articulate, constriction in middle	1-articulate, constriction in middle
Gnathopod 1, palmar corner two spines	one spine displaced	one spine displaced	two spines close together
Gnathopod 1, dactylus	aquilinized	non-aquilinized	?
Pereopod 6, number of groups of spines on propodal posterior margin	2–4	7	4
Pereopod 7, number of groups of spines on propodal posterior margin	4	7	3
Uropod 1, distolateral spine of peduncle	elongate	elongate	ordinary size
Uropod 1, number of dorsal spines on outer ramus	2	6	2
Uropod 3, inner ramus	fully articulated	fully articulated	?
References	Shoemaker (1956); Stock (1987)	Stock (1987)	Iwasa (1939)

Characteristic	*P. basrensis* Salman, 1986	*P. hachijoensis* sp. nov.	*P. philippinensis* sp. nov.
Antenna 2, number of flagellar articles	19	26+	30
Maxilla 1, palp	1-articulate, constriction in middle	2-articulate	1-articulate, constriction in middle (male)
Gnathopod 1, palmar corner tow spines	two spines close together	one spine displaced	two spines close together
Gnathopod 1, dactylus	aquilinized	non-aquilinized	aquilinized
Pereopod 6, number of groups of spines on propodal posterior margin	4	4	5
Pereopod 7, number of groups of spines on propodal posterior margin	3	3	5
Uropod 1, distolateral spine of peduncle	ordinary size	ordinary size	elongate
Uropod 1, number of dorsal spines on outer ramus	3	2	5
Uropod 3, inner ramus	fully articulated	fused to peduncle	fully articulated
References	Salman (1986)	herein	herein

* Stock (1987) found the constriction in the middle of the palp on maxilla 1 during a re-examination of Shoemaker's (1956) specimen.

slightly deeper than merus, with deep serration and pectinate long setae; propodus with palm oblique, defined by 2 spines, middle of posterior margin with a strong tumidity bearing long setae; dactylus fitting palm.

Coxae: coxa 1 (Fig. 4a) extended forward; coxa 4 (Fig. 3k) slightly broad, with bisinuate posterodorsal excavation.

Pereopod 3 (Fig. 3l): distal end of anterior margin of merus with long spine.

Pleopods 1–3: each peduncle bearing 2 hook spines, inner margin of basal article of inner ramus lined with 2, 4, and 5 bent-tip spinules, respectively.

Brood plate: brood plate of gnathopod 2 (Fig. 3i) subovate, extending well beyond basis; margin with 90 medium-long hooked setae (Fig. 3j). Brood pouch empty.

Remarks. *Parhyale hachijoensis* resembles *P. iwasai* as drawn by Iwasa (1939), but the new species is distinguished from the latter by the following features: in the maxilliped the ventrodistal margin of palp article 3 has dense, long setae (vs. sparse setae); in the male gnathopod 1 the propodus expanded distally (vs. a slender, concave posterior margin), and one of the palmar corner spines is displaced to the posterior margin (vs. palmar corner spines close together) (see Table 1).

Parhyale hachijoensis is also close to *P. hawaiensis*, as drawn by Shoemaker (1956), but the new species can be distinguished from the latter by the following points: in maxilla 1 the palp is 2-articulate and the tip of the palp reaches slightly beyond the outer plate (vs. palp 1-articulate, and the tip of the palp not reaching the distal end of the outer plate); in pereopod 6 the carpus and propod are robust (vs. slender), and the anterior and posterior margins of the propodus are lined with four and four groups of spines (excluding locking spines), respectively (vs. five to eight and two to four groups of spines, respectively); in uropod 1 the distolateral spine of the peduncle is not elongate (vs. elongate); in uropod 3 the inner ramus is fused to the peduncle (vs. inner ramus fully articulated) (see Table 1).

Habitat. The new species occurred under cobbles in the intertidal zone.

Distribution. The new species has been found only at Hachijo Island in the Izu Islands of southeastern Japan.

Parhyale philippinensis sp. nov.

(Figs 5–8)

Material examined. One male and 1 ovigerous female on *Ulva* sp. at the low tide line at Cagayan De Oro, Mindanao Island, the Philippines (8°30′N, 124°45′E), 11 May 1982; 1 male (8.6 mm), the same place, 15 May 1982; 6 males (14.2 mm, 13.6 mm, 12.1 mm, 10.8 mm, 10.7 mm, 10.4 mm) and 1 ovigerous female (10.2 mm), in seagrass debris on rocks, Bolinao, Tandoyong Island, off northwestern Luzon Island, the Philippines (16°25′N, 119°50′E), 23 April 1982. Holotype: male (NSMT-Cr.13929, slide mount), 10.0 mm, Cagayan De Oro, the Philippines, 11 May 1982. Allotype: ovigerous female (NSMT-Cr.13930, slide mount), 6.6 mm, same data as holotype.

Diagnosis. Antennae 1 and 2: flagella long, with 19 and 30 articles, respectively; antenna 2 with peduncular articles 4 and 5 elongate. Eyes: relatively small, reniform. Maxilla 1: palp 1-articulate with constriction slightly beyond midlength. Maxilliped: ventrodistal margin of palp article 3 with dense long setae. Gnathopod 1: carpus lobe broad, with deep serration and pectinate long setae; propodus palmar corner spines closely set; dactylus aquilinized. Gnathopod 2: carpus lacking posterior lobe. Pereopods 6 and 7: posterior margins of propodi lined with 5 groups of spines. Uropod 1: peduncle with elongate distolateral spine. Uropod 3: inner ramus fully articulated.

Description. *Male* (holotype). Head (Fig. 5g): relatively small; eyes small, reniform.

Antenna 1: peduncular article 3 not reaching end of peduncular article 4 of antenna 2 (Fig. 5g); each article of flagellum with 2 short aesthetascs (Fig. 5c); faces of peduncular articles 1–3 naked; flagellum 19-articulated. Antenna 2: relatively long, about 55% of body length; peduncular article 5 slightly longer than article 4; articles 4 and 5 with several groups of short setae and spines (Fig. 6b); each article of flagellum with 4 groups of short setae distally (Fig. 5d); flagellum 30-articulated, about twice as long as peduncle.

Upper lip (Fig. 5a): anterior margin rounded with bristles. Left mandible (Fig. 6e): lacinia 5-dentate with 6 accessory blades. Right mandible (Fig. 6f): lacinia with 4 accessory blades, distal end of molar with long plumose seta. Maxilla 1 (Fig. 6c): palp 1-articulate with constriction slightly beyond midlength. Maxilla 2 (Fig. 6d): inner plate with large pectinate seta at middle of medial margin; apical setae of outer plate longer than that of inner. Maxilliped (Fig. 6g): palp articles 2 and 3 broad; article 4 (Fig. 6h) slender, outer and inner margins with 1 and 7 setae, respectively; ventrodistal margin of palp article 3 with dense long setae.

Gnathopod 1 (Fig. 6i): basis with 2 stiff setae in middle of posterior margin; merus with long setae; carpus lobe broad, with deep serration (Fig. 6j) and pectinate long setae; propodus expanded distally, palm oblique, 2 corner spines closely set, posterior margin with setae on distal half, inner face with 3 groups of stiff setae; dactylus fitting palm, inner margin minutely ridged, straight, aquilinized. Gnathopod 2: propodus with palm convex and with hollow near defining corner, lined with short spines (Fig. 7a) [in drawing, palmar spines look smaller than actual size because of erect spines on inner and outer faces; cf. other male's (B.L. = 13.6 mm) palmar spines (Fig. 8g)], posterior margin slightly longer than palm, with small setae; dactylus fitting palm. Pereopods: pereopods 3–7 each with pair of locking spines; pereopods 3 and 4 (Fig. 7b) with locking spines subequal in size, posterior margins of propodi lined with 3 spines (excluding locking spines); pereopods 5–7 (Fig. 7c, d, e) with distal locking spine larger, anterior margins of propodi lined with 5, 7, and 5 groups of spines, respectively; pereopods 6 and 7 with posterior margins of both propodi lined with 5 groups of spines; dactyli of all pereopods with apical nail, inner margin smooth, with robust inner setule near middle.

Coxae: coxa 1 (Fig. 5g) extended forward; coxae 2–4 with lower margin rounded; coxae 1–3 with middle of posterior margin projecting, softly pointed; coxa 4 broad, with bisinuate posterodorsal excavation; coxal gills relatively large.

Pleopods 1–3: each peduncle bearing 2 hook spines; on pleopods 1 and 3, inner margin of basal article of inner ramus lined with 5 and 6 bent-tip spinules, respectively (that of pleopod 2 obscure owing to poor slide mount).

Epimera 1–3 (Fig. 5g): with 3, 8, and 6 small setae on posterior margins, respectively.

Uropod 1 (Fig. 5g): peduncle slightly longer than rami, with marginal spines and elongate distolateral spine, latter about 30% as long as outer ramus; outer and inner rami with 5 and 4 dorsal spines, respectively. Uropod 2: both inner and outer rami with 3 dorsal spines. Uropod 3 (Fig. 5f): peduncle widely expanded, with 1 main spine; inner ramus fully articulated; outer ramus obliquely truncate, bearing 7 spines.

Telson (Fig. 5b) cleft completely, inner margins of lobes with short comb setae, lateral margins with 2 plumose setae each, apical margin with plumose seta and short spine.

Female (allotype). Antenna 1 (Fig. 7f): anterior margins of peduncular articles 1 and 2 with a few short setae each. Antenna 2: peduncular articles 4 and 5 shorter than those of male (Fig. 7g).

Maxilla 1 (Fig. 7h): palp 2-articulated, articulation positioned slightly beyond midlength. Maxilliped (Fig. 7j): setae of palp article 3 not as dense as in male.

Gnathopod 1 (Fig. 8b): carpus similar to that of male, lobe broad, with deep serration and pectinate long setae; propodus subrectangular, palm oblique, simple, defined by 2 spines, distal half of posterior margin bearing setae; dactylus fitting palm. Gnathopod 2 (Fig. 8c): basis expanded distally, anterodistal corner extended; carpus similar to that of gnathopod 1, lobe broad, with deep serration and pectinate long setae; propodus expanded in middle, palm oblique, simple, defined by 2 spines, distal half of posterior margin bearing setae; dactylus fitting palm.

Coxae: coxa 1 (Fig. 8a) extended forward; coxa 4 (Fig. 7i) slightly broad, with bisinuate posterodorsal excavation.

Brood plate (Fig. 7k): brood plate of gnathopod 2 subovate, reaching ca. 30% beyond basis of gnathopod 2, margin with 68 hooked setae of medium length (Fig. 7l). Egg number 9.

Young male (5.6 mm). Maxilla 1 (Fig. 8d): palp 1-articulated, constricted slightly beyond midlength. Maxilliped (Fig. 8f): setae of palp article 3 not as dense as in adult male. Gnathopod 2 (Fig. 8e): carpus with long setae on narrow lobe.

Remarks. *Parhyale philippinensis* resembles *P. hachijoensis*, but the present new species is distinguished from the latter by the following features: in antenna 1 the posterior margins of peduncular articles 1, 2, and 3 have no spines (vs. several pairs of spines); in antenna 2 peduncular articles 3, 4, and 5 have sparse, short spines (vs. long, dense spines); in maxilla 1 of the male, the palp is 1-articulate with a constriction slightly beyond midlength (vs. 2-articulate with the articulation slightly beyond midlength); in gnathopod 1 the two propodal palmar corner spines are close together (vs. one of them displaced to the posterior margin); in uropod 1 the peduncle has an elongate distolateral spine (vs. an ordinary distolateral spine); in uropod 3 the inner ramus is fully articulated (vs. fused to the peduncle and vestigial); and gnathopod 2 of the female, the middle of the posterior margin of the propodus is slightly expanded (vs. strongly tumid) (see Table 1).

Parhyale philippinensis is also close to *P. hawaiensis*, as drawn by Shoemaker (1956), but the new species can be distinguished from the latter by the following points: in the male gnathopod 1 the propodal palmar corner spines are closely set (vs. widely displaced); in pereopod 6 the propod posterior margin is lined with five groups of spines (vs. two to four groups of spines); in uropod 1 the outer ramus has five dorsal spines (vs. two dorsal spines); and in the female gnathopod 2 the propod palm is weakly oblique and shorter than the posterior margin (vs. palm strongly oblique and longer than posterior margin) (see Table 1).

Stock (1987) stated that the morphology of fully adult males of the *P. hawaiensis* complex is characterized by the following 3 features: 1) one of the palmar corner

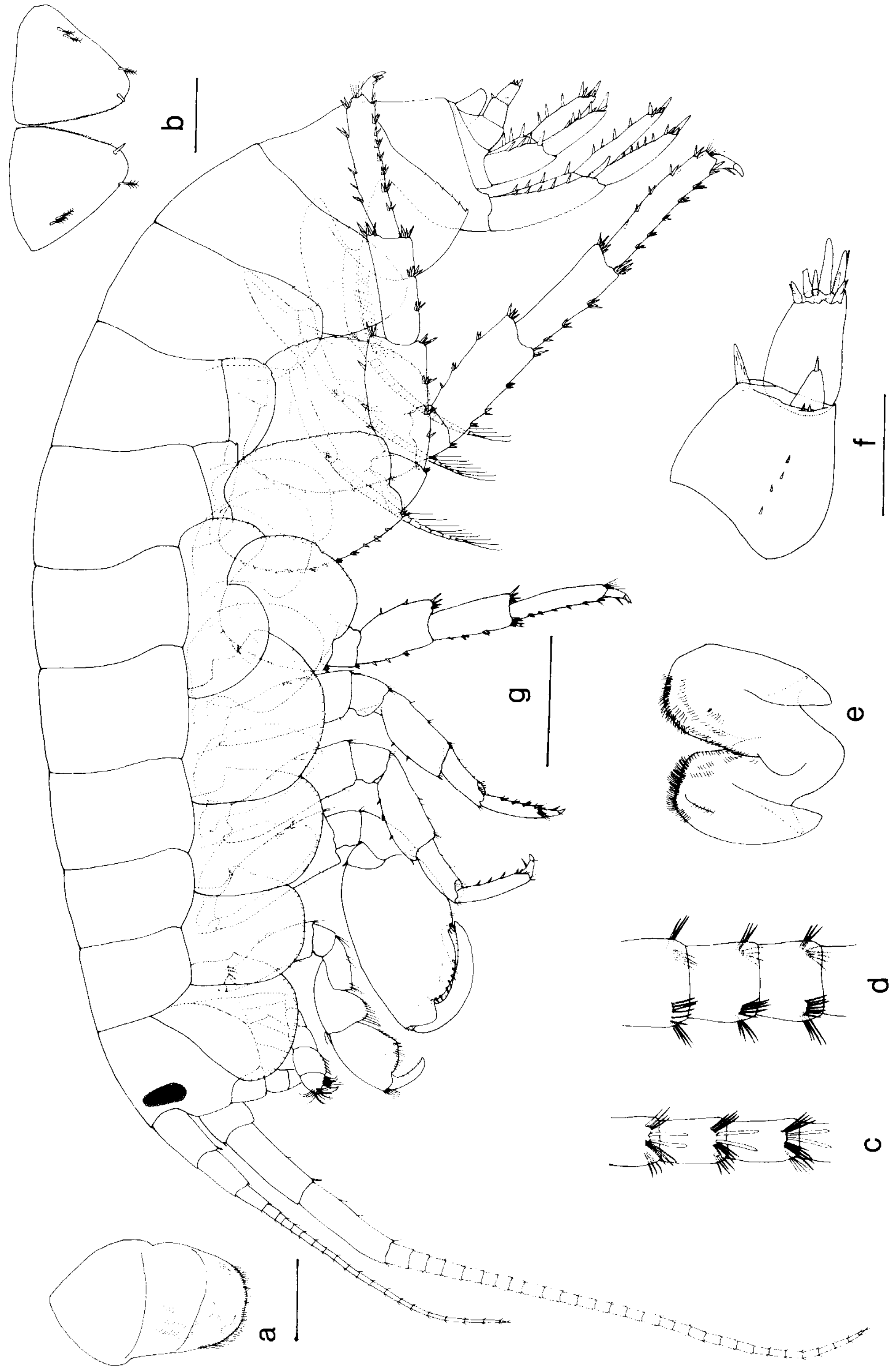

Fig. 5. *Parhyale philippinensis* sp. nov., holotype (male, 10.0 mm). a, upper lip; b, telson; c, part of flagellum of antenna 1; d, part of flagellum of antenna 2; e, lower lip; f, uropod 3; g, lateral view. Scale bars: g=1 mm; a–f=0.2 mm.

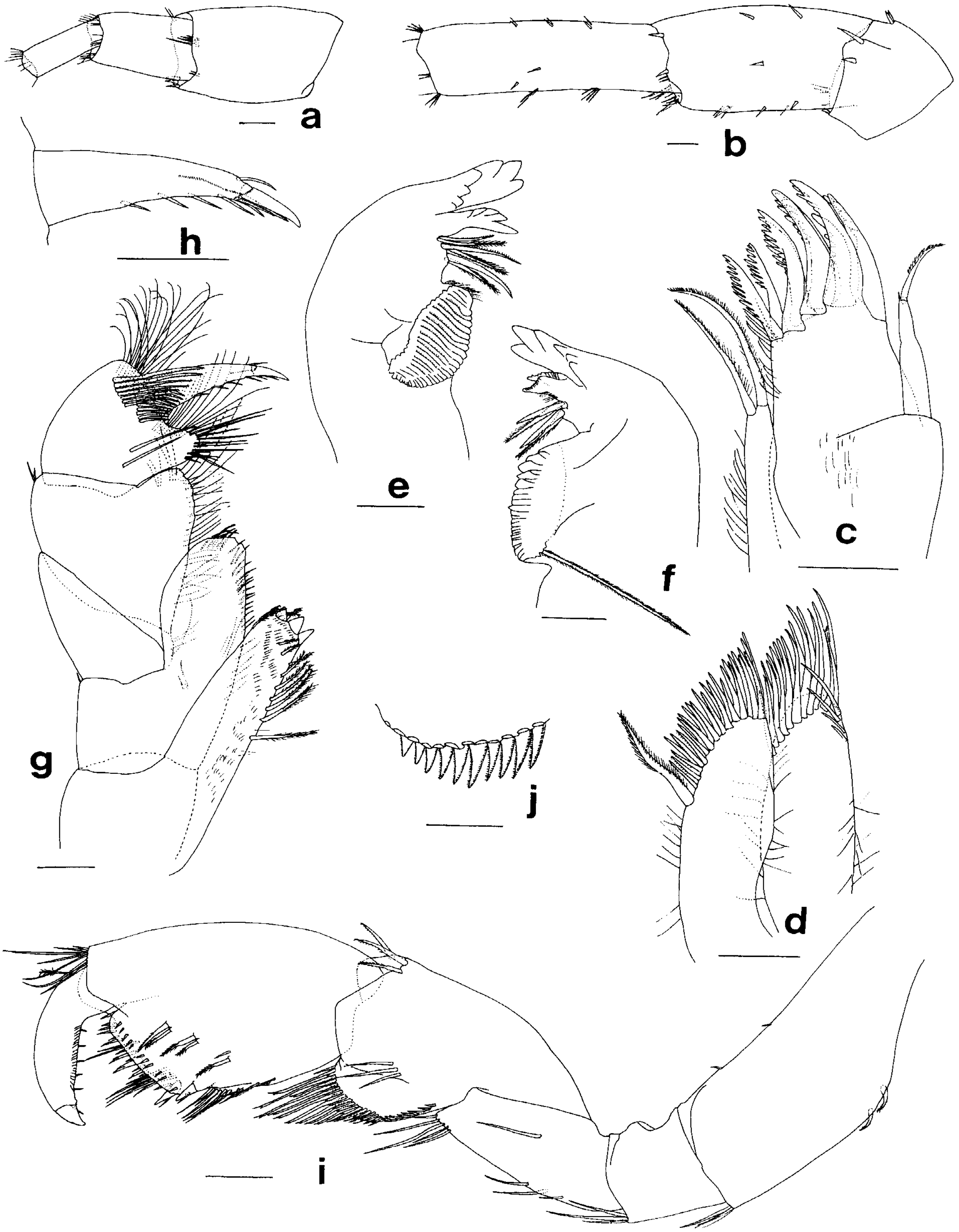

Fig. 6. *Parhyale philippinensis* sp. nov., holotype (male, 10.0 mm). a, peduncular articles of antenna 1; b, peduncular articles of antenna 2; c, maxilla 1; d, maxilla 2; e, left mandible; f, right mandible; g, maxilliped; h, article 4 of maxilliped palp; i, gnathopod 1; j, part of deep serration of margin of carpal lobe of gnathopod 1 (pectinate long setae omitted). Scale bars: a–i = 0.1 mm; j = 0.05 mm.

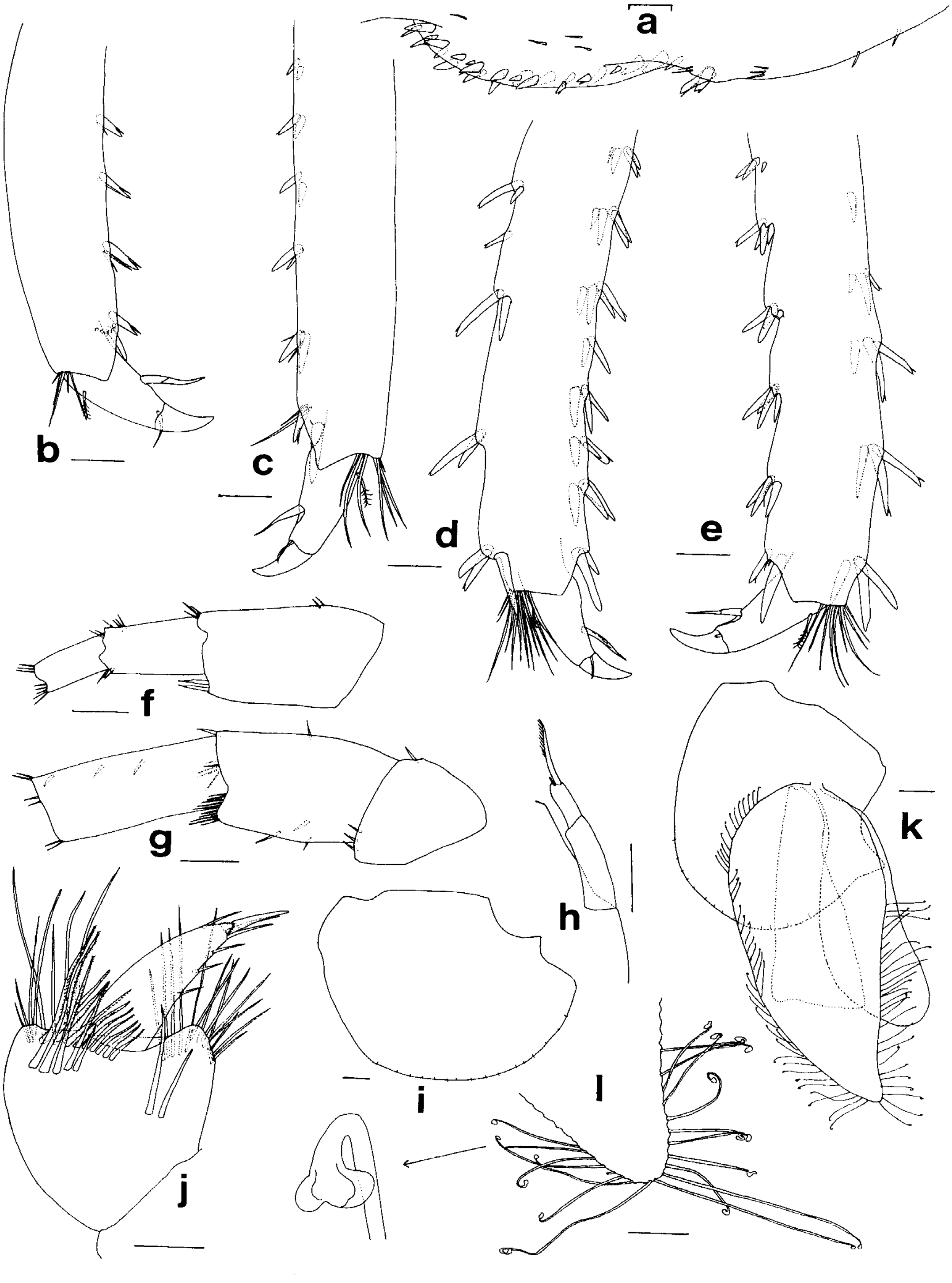

Fig. 7. *Parhyale philippinensis* sp. nov. a–e, holotype (male, 10.0 mm): a, propodal palm margin of gnathopod 2; b–e, propodi and dactyli of pereopods 4–7, respectively. f–l, allotype (female, 6.6 mm): f, peduncular articles of antenna 1; g, peduncular articles of antenna 2; h, palp of maxilla 1; i, coxa 4; j, articles 3 and 4 of maxilliped palp; k, coxa 2 and brood plate; l, brood setae of brood plate. Scale bars: a–g, i, k=0.1 mm; h, j, l=0.05 mm.

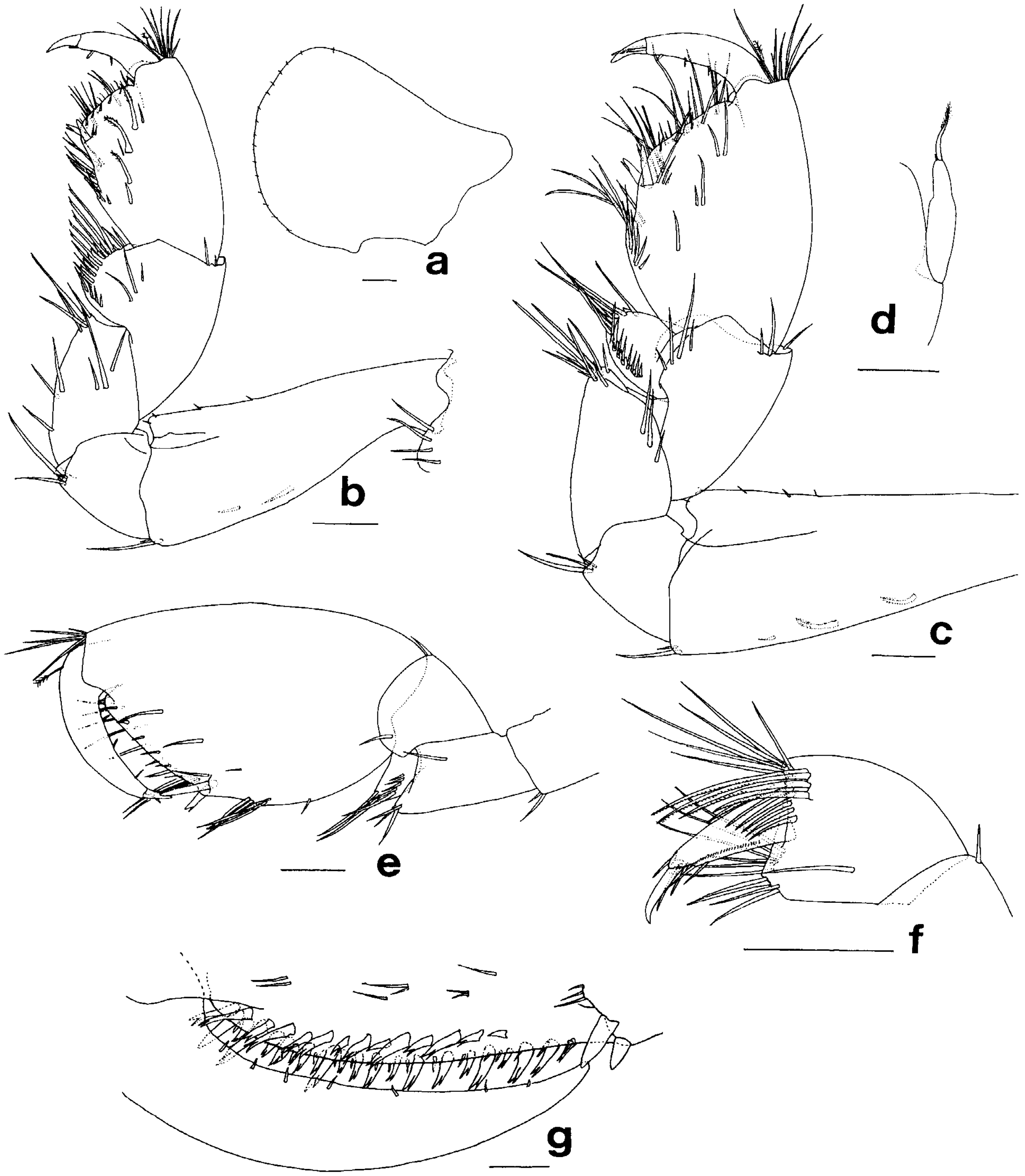

Fig. 8. *Parhyale philippinensis* sp. nov. a–c, allotype (female, 6.6 mm): a, coxa 1; b, gnathopod 1; c, gnathopod 2. d–f, young male (5.6 mm): d, palp of maxilla 1; e, distal part of gnathopod 2; f, articles 3 and 4 of maxilliped palp. g, male (13.6 mm), propodal palm margin and dactylus of gnathopod 2. Scale bars: a–c, e, g=0.1 mm; d, f=0.05 mm.

spines of gnathopod 1 is displaced to the posterior margin; 2) the dactylus of gnathopod 1 is widened in the middle (called "aquilinization"); and 3) the setiferous lobe of the carpus is fully absent. With regard to characteristic 1, Stock (1987) also mentioned that the two palmar corner spines in subadult specimens are set closely together, but after the next molt, they become spaced. Although characteristics 2 and 3 fit *P. philippinensis*, the first does not. Although one might suspect that individuals of *P. philippinensis* with the two palmar corner spines close together might be subadults of the *P. hawaiensis* complex, the maximum male body length (14.2 mm) among the specimens examined in this study indicates that the specimen must have been fully adult. In all of these specimens the two palmar corner spines were set close together, as in the holotype (body length 10.0 mm). This means that the lack of displacement of the two palmar corner spines in the fully adult male is probably fixed genetically. Therefore, *P. philippinensis* is judged to belong to the *P. hawaiensis* group but outside of Stock's (1987) category.

Habitat. The new species occurred on a green alga, *Ulva* sp., at the low tide line and in seagrass debris on rocks. The species was not able to saltate in air.

Distribution. The new species was found only at two coastal sites in the northern and southern Philippines.

Discussion

In the remarks on the two new species, *Parhyale hachijoensis* is distinguished from *P. hawaiensis* and *P. iwasai*, and *P. philippinensis* from *P. hawaiensis*. In addition, differences between the characteristics of the two new species and those of *P. multispinosa* and *P. basrensis* are shown in Table 1. *Parhyale hachijoensis* can be distinguished from *P. multispinosa* by the characteristics of the palp of maxilla 1, pereopods 6 and 7, and uropods 1 and 3; and from *P. basrensis* by the characteristics of antenna 2, the palp of maxilla 1, gnathopod 1, and uropod 3. *Parhyale philippinensis* can be distinguished from *P. multispinosa* by the characteristics of antenna 1 and the propodus and dactylus of gnathopod 1; and from *P. basrensis* by the characteristics of antenna 2 and uropod 1.

As mentioned in the Introduction, the generic characteristic that distinguishes *Parhyale* from *Parallorchestes* is the presence of a 1-articulate palp on maxilla 1 (Barnard and Karaman 1991); however, there is a weak articulation near the middle of the palp (2-articulate) on both the left and right maxillae 1 in male and female *Parhyale hachijoensis* (Figs 2c, 4d, e, f), as well as in female *P. philippinensis* (Fig. 7h). The supposed generic characteristic of *Parhyale* is thus of no distinguishing value. Instead, I suggest following re-examination of this palp in the type material of other *Parhyale* species, a weak articulation or constriction near the middle of the palp might prove useful as a new generic characteristic of *Parhyale*.

Until now, 13 species of *Parhyale* have been described, and maxilla 1 of 11 of these has been illustrated. Eight species show a constriction near the middle of the palp. This feature is not shown in the illustrations of the other three species, but it might have been overlooked because it is quite tiny. Shoemaker (1956) mentioned with respect to the inner ramus of uropod 3, "An inner ramus on uropod 3 could easily have been overlooked", and the same is true for this palp. In fact, Stock (1987) found a weak constriction in the middle of the palp on maxilla 1 of *P.*

hawaiensis upon re-examination of the specimen drawn by Shoemaker (1956). A weak articulation or constriction near the middle of the palp of maxilla 1 might be regarded as the same state that is present in *Parallorchestes*. The difference between the two is the position of the articulation, in *Parhyale* near the middle of the palp, but in *Parallorchestes* at the extreme basal end of the palp [see the illustrations of *Parhyale kurilensis* (Iwasa, 1934), which was synonymous with *Parallorchestes ochotensis* (Brandt, 1851)(Barnard 1979), and of *Parallorchestes asiaticus* Tzvetkova, 1990]. A difference in the position of this articulation may not be sufficient in itself as a generic character alone, but this proposal is a starting point for more detailed study of the *Parhyale-Parallorchestes* complex.

Acknowledgements

The author wishes to thank Dr. S. Suda of the Marine Biotechnology Institute, who donated some of the specimens examined in this study, and Dr. E. C. Flores of the University of the Philippines, for his helpful advice in planning the field trip in the Philippines. I am also very grateful for useful comments and critical reading of the manuscript by Drs. H. Morino (Ibaraki University), L. Watling (University of Maine), and E. L. Bousfield (Royal Ontario Museum).

References

Arresti, A. 1989. *Parhyale explorator*, a new species of talitroid amphipod from the bay of Arcachon, France. Bulletin du Muséum National d'Histoire Naturelle. Paris, (4) 11 (A, 1): 101–115.

Barnard, J. L. 1979. Littoral gammaridean Amphipoda from the Gulf of California and the Galapagos Islands. Smithsonian Contributions to Zoology 271: 1–149.

Barnard, J. L. and Karaman, G. S. 1991. The families and genera of marine gammaridean Amphipoda (except marine gammaroids). Records of the Australian Museum, Supplement 13: 1–866.

Bulycheva, A. I. 1957. Morskie Bloxi Morej SSSR i Sopredel'nyx Vod (Amphipoda-Talitroidea). Opredeliteli po Faune SSSR, Akademija Nauk SSSR 65: 1–185.

Iwasa, M. 1939. Japanese Talitridae. Journal of the Faculty of Science, Hokkaido Imperial University, Series 6 (Zoology) 6: 255–296, pls 9–22.

Krapp-Schickel, G. 1974. Camill Hellers Sammlung Adriatischer Amphipoden—1866 und heute. Annalen der Naturhistorisches Museum, Wien 78: 319–379, 28 pls.

Salman, S. D. 1986. *Parhyale basrensis*, a new species of talitrid Amphipod from the Shutt Al-Arab region, Iraq. Crustaceana 50 (3): 287–294.

Shoemaker, C. R. 1956. Observations on the amphipod Genus *Parhyale*. Proceedings of the United States National Museum 106 (3372): 345–358.

Stebbing, T. R. R. 1897. Amphioda from the Copenhagen Museum and other sources. Transactions of the Linnean Society of London, Series 2 (Zoology) 7: 25–45, pls 6–14.

Stock, J. H. 1987. Stygofauna of the Canary Islands, 5. A hypogean population of *Parhyale* (Amphipoda) in the Jameos del Agua lava tunnel (Lanzarote), a supposed case of recent evolution. Stygologia 3 (2): 167–184.